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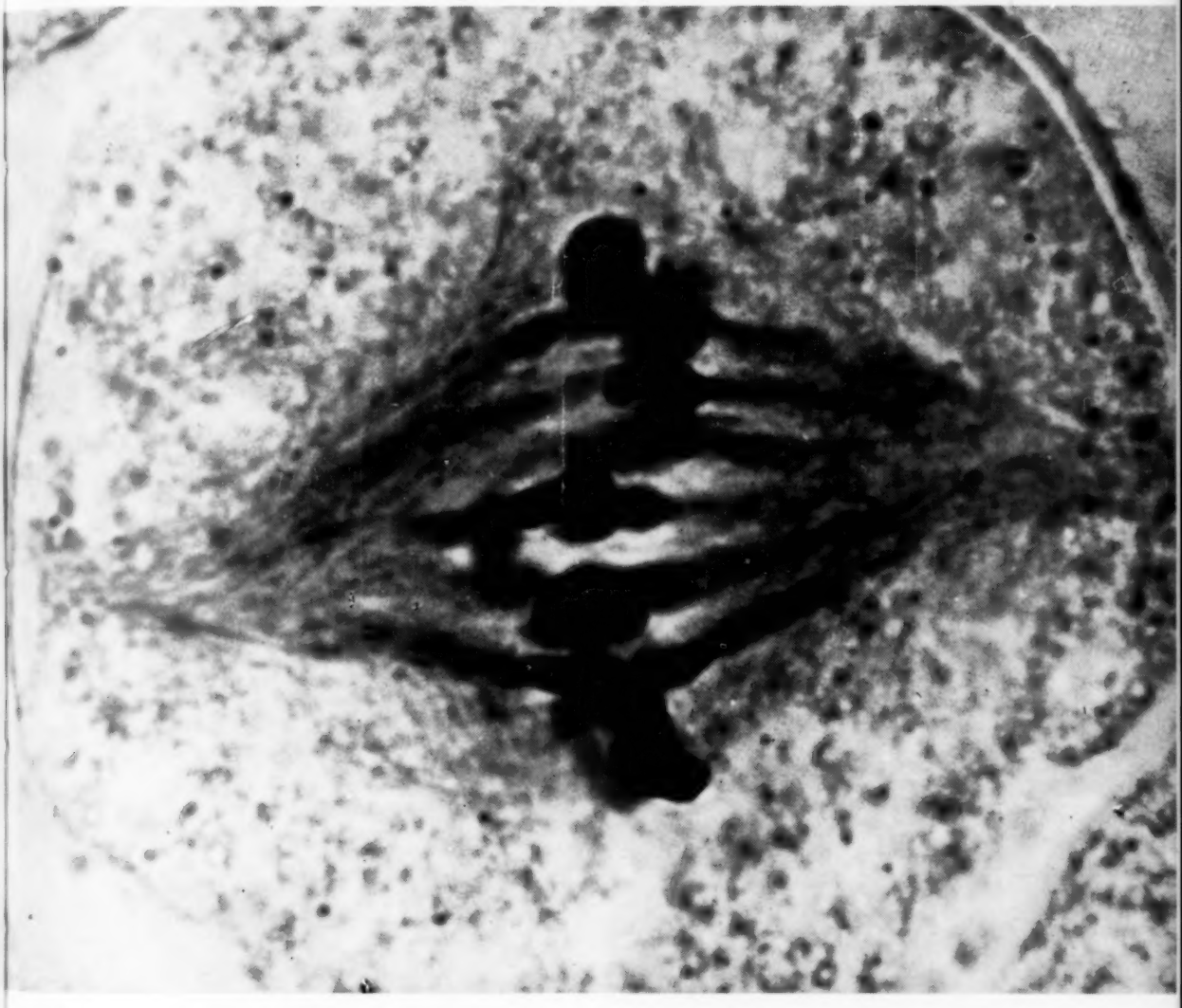

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THE AMERICAN BIOLOGY TEACHER

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Teaching Biology by a Combination of Methods or Biology Teaching in "Three-D"

SAMUEL L. MEYER
Professor of Botany,
Florida State University

How shall we teach what we teach? It is not my purpose here to enter into any of the time-worn controversies concerning the relative merits of lectures versus discussions or laboratories versus demonstrations. We will probably all agree that there is no one *best* method of teaching. All methods have their elements of strength and their elements of weakness. We shall probably all agree that different people teach most effectively by different methods. The best teaching undoubtedly results from a combination of clearly defined objectives, carefully selected materials, and the method best suited to the teacher's own talents. However, it is my opinion that we sometimes get in a rut as far as teaching methods are concerned. We may almost become fanatically prejudiced in favor of one method as opposed to another. Such short-sightedness may blind us to the sources of strength that may be added to our teaching effectiveness through a combination of methods. It is my purpose here to call your attention to the contribution which can be made to effective teaching through utilization of combined resources.

It is not always easy to find the proper terminology to be used in differentiating one method from another. In fact, there is no little confusion in such terminology. In this presentation, I stall refer to the "three-D's" in biology teaching: *discourse*, *discussion* and *discovery*. From these approaches to our science, we have tried to create a pattern of teaching which will impart to the student both information and inspiration. Let us now consider each method in some detail.

[1]Presented at a joint meeting of the Florida Association of Science Teachers and the National Association of Biology Teachers as part of the The American Institute of Biological Sciences program, Gainesville, Florida, September, 1954.

1. The *discourse*. This is obviously the use of the lecture method, a technique which, for some reason or another and in some quarters, has fallen into disrepute. The great majority of college teachers use it, but few use it effectively. One of my former colleagues once described the lecture method as "wiring a textbook to sound." Another biologist has termed it a situation during which "the notes of the professor become the notes of the student without going through the mind of either." A brochure of a liberal arts college which emphasizes the conference plan of instruction refers to it as "the pouring of knowledge into a passive receptacle."

In spite of its weaknesses, in spite of the training in addition to knowledge of subject matter it requires, it is my sincere belief that the lecture method can provide thrilling experiences for both students and teacher unmatched by any other technique. There are few teachers who are masters of the lecture method. One was Dr. E. E. Reinke who, for many years before his death, was Head of the Biology Department at Vanderbilt University. Many students at Vanderbilt took General Biology not because they were particularly interested in the contribution that subject might make to their education, but because they felt that a degree from Vanderbilt would have lost something of its significance if they graduated without having had "Dr. Reinke's course." It was an exciting experience for me as a young instructor to sit in the back of the lecture hall and watch the master teacher work. By the forcefulness of his personality, the logic of his organization, the originality of his ideas, the enthusiasm of his presentation he would make the facts of biology meaningful, he would light the fires of intellectual curiosity in the minds of the young people

whose lives he touched. True it is that few men can lecture as E. E. Reinke could. My present concern is that, for some reason, we are not creating in young graduate students the desire to achieve such perfection.

A lecture need not be a dull and uninteresting recitation of dead facts. It can be a living vital thing, picture, a poem, a song. It can reveal in the impressive and inspiring fashion that only the spoken word can convey the fascinating story of embryonic development; the intricate structure of plants and animals; the marvels of adaptation; the significance of photosynthesis; the mystery of the origin of life; the explanation of inheritance; the contributions of biology to human welfare; the hopes, the successes and the failures of the pioneers in the inspiring history of our science. The discourse, the lecture method has much to recommend it as an effective teaching tool.

2. The *discussion*. Here we shall consider teaching by the method usually described by the term "discussion" or what S. M. Dietz has called the "group-conference system." According to Dietz, this technique "makes it possible for the student to think in the subject using information and results accumulated individually and in groups." At Florida State University during any period or part of a period when we use the discussion method, all students study the same materials, perform the same experiments, observe the same demonstrations, solve the same problems. However, the topics discussed between individual students, between groups of students, between individual students and the teacher, and between groups of students and the teacher may vary considerably. The student finds himself in an atmosphere of freedom and informality and, at the same time, in a learning situation which makes rigorous demands of his abilities. He must observe; he must describe; he must interpret; he must criticize; he must organize; he must defend. The teacher, on the other hand, finds the situation one that is exacting in its requirements of training, experience, and personality. It is his responsibility to develop the proper "atmosphere" in the classroom. There is no limit to the variety of questions that will come his way, the problems he will be called upon to solve, the differences of opinion he must resolve. Yet, he must never lose sight of the trend of thought, the theme, the objective for the day. He must know how to balance the discussion; how to encourage the shy and the backward; how to control the aggressive and the talkative; just the right moment to call on the right student for the right answer; how to project himself into a discussion or, and this is even more difficult, how to withdraw himself from it.

Bower Aly has pointed out several things that a discussion is *NOT*. He says, "Modern classroom discussion is not a dialogue between two or three bright pupils on the front row. It is not a question hour in which students ask a few questions and the teacher gives forth elaborate answers. It is not a period in which a teacher condescends to the group."

On the other hand, Aly states that "To be successful with the discussion method, the teacher must assume the role of learner along with his students. He must cast off the garments of infallibility and appear as one of a group seeking knowledge of a subject which commands interest and even admiration." Jacques Barzun observes that "Handling a discussion group requires special talent." He compares the role of the discussion leader to "that of an orchestra conductor except that neither he nor the members of his orchestra have a score before them. Yet the result of the evening's noise must be as intelligible as a symphony." Cardinal Newman emphasizes the strength of the discussion method when he says, "No book can convey the special spirit and delicate peculiarities of its subject with that rapidity and certainty which attend on the sympathy of mind with mind, through the eyes, the look, the accent, and the manner in casual expressions thrown off at the moment, and the unstudied terms of familiar conversation." In the presentation of many kinds of material, the discussion method can be used with great effectiveness.

3. *Discovery*. In this the third- D of the group, we include a variety of experiences with emphasis on the material itself. Through his own efforts, the student discovers information and sources of information. This discovery may be facilitated by observations under the microscope, a dissection, a field trip, a movie, a lantern slide, a chart, a map, a model, an experiment, a demonstration, a reference in a book, an original research paper. W. Hugh

Stickler refers to the conflict between the relative merits of the "demonstration" versus the "laboratory." It is his opinion that much of the so-called "controversy" lies in the definition of terms. In that he is certainly correct. It is impossible to teach biology by talking about it. The experienc to be remembered by the student is that which results from contact with the material itself. One of the advantages enjoyed by the biology teacher is that his subject matter is alive. For that reason, whenever possible, we strongly recommend use of living material in the classroom or in the field. Sometimes, however, the most fruitful observations cannot be made on living things. A phase in a life history, a stage in development, a structure may be revealed best through the use of preserved or fixed and stained material. Whenever possible these discoveries should be made by the student for himself. On the other hand, as Stickler points out, "If a difficult concept needs clarification, if expensive and complicated equipment is necessary, or if the undertaking is time consuming, the demonstration may have advantages." Even in such cases we believe that the responsibility for the mental effort needed to make the observations and draw the inferences should be provided by the student. Excellent materials, carefully prepared dissections, well planned experiments, revealing demonstrations and stimulating field trips are the tools of direct discovery. They are very important. In a quotation used by Stickler and repeated here, it is pointed out that "This direct study of material was the original source from which came the content of books, the subject matter of lectures, the substance of group discussions and of examinations . . . . this was the source from which came the facts that yielded the fundamental laws and basic truths by which humanity has advanced."

One of the master teachers by the method of direct discovery was Dr. Ivey F. Lewis of the University of Virginia. In a walk through the woods, students would collect pine cones containing immature ovules. Back in the laboratory, Dr. Lewis would demonstrate the method of making free-hand sections with a casual manner that was deceptive in its impression of simplicity while giving a graphic account of the contributions to botanical knowledge of the earliest students of plant morphology. During all this, the rhythm of the puffs of smoke arising from his pipe was rarely distributed. When the sections were examined under the microscope, the interest and enthusiasm revealed by Professor Lewis brought the thrill of original discovery to each member of the class. In the spirit of the occasion, students were transported from a twentieth century class room to the laboratory of Wilhelm Hofmeister as he for the first time interpreted the significance of his own hand sections of similar structures. Professor Lewis skillfully employed the thrill of discovery as a method by which the facts of science might be acquired.

In addition, the modern biology teacher has available many valuable tools of indirect discovery. These include attractively colored charts which show differentiation of structure and form more clearly than ever before; lifelike models of vinyl plastic; latex reconstructions; projection slides in natural color; film strips which combine photographs, drawings and script to present significant topics of biological interest; and movies, particularly those using time lapse photography, which condense processes and life cycles that may require hours or months for completion, into a few minutes, and which convey information more clearly than either the written or the spoken word. Indirect discovery is facilitated also by references to textbooks, scientific journals, popular magazines, and newspapers. The reference may include a paragraph, a picture, a chart, a well-turned phrase, a vivid description. Whatever its source, whatever its nature, it must be available at the exact moment needed else its significance is lost and its value reduced to the minimum. In my own teaching, the sources of this reference material made available to the student in the classroom range all the way from the most recent edition of a widely used textbook to a best seller on the Book-of-the-Month Club list, from *The American Scientist* to *Time* magazine, from *The New York Times* to *The Tallahassee Democrat*.

The tools of direct and indirect discovery are constantly being improved. The alert teacher keeps himself informed of such advances. The use of new materials not only increases teaching effectiveness but motivates learning to a remarkable degree.

Discourse, discussion, and *discovery!* These are the resources available for the effective teaching of biology. No one needs to be used to the exclusion of the others. No one is better than the others. Whatever the method, or combination of methods, in any analysis of effective teaching, we come ultimately to the teacher himself. It is his enthusiasm for his subject, his interest in young people, his grasp of the pertinent information in his field and its significance,—it is all these which form that vital, yet intangible, pathway for exchange of ideas and inspiration between student and teacher. Just as the master painter blends his colors to produce a picture of great beauty so he who aspires to be a master teacher of biology must work out the proper balance of those resources which will transmit to youthful minds the fascinating story of the science of living things.

Careers in Biology[1]

MICHAEL P. WALSH
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A number of reliable surveys have clearly indicated the critical shortage of manpower existing today in all branches and levels of science. The increasing demands that private industry and the government have made within the past decade on young scientists have left a gap in university research and teaching programs, and in many instances, have forced a sacrifice of pure research in favor of technical progress and applied science. There is no need to emphasize the results that this may have on the welfare of our country.

The situation is even more serious in the field of high school science teaching where the shortage of teachers is actually approaching an acute crisis. Today there are 67,000 science teachers in our high schools throughout the country. With the sharp rise in post-war births, high school enrollments are expected to rise to 9 million in 1960 and over 11 million in 1965. In 1960, over 84,000 science teachers will be needed and 100,000 in 1965. Already some 7,000 new science teachers are needed annually as replacements. In the face of this need, sources of teaching strength are dwindling and will continue to do so for another few years. In fact, in recent years because of more attractive opportunities in other fields, science has produced the fewest teachers of any subject area.

In still another field closely allied to biology, namely, medicine where competition has been extremely high in recent years, there has been a noticeable drop in the number of qualified applicants to medical schools. In 1953, there were ten thousand fewer applicants than in 1949. Where less than 25% of those who applied to medical schools in 1949 were accepted, in 1953 over 50% of all applicants were admitted.

With the rapid advances that have been made in the biological sciences in recent years, it is obvious that biologists will be needed in large numbers not only by academic institutions but also by private industry, the government, and even the military branches of the government. In the area of atomic energy, there are problems related to biology that have been only superficially investigated. The Department of Defense and the Atomic Energy Commission and other government centers of chemical and biological research will need biologists in larger numbers as they continue to expand their programs and facilities. At the international level, organizations like the United Nations with its Food, Health, and Agricultural Committees have opened new fields for trained biologists.

Industry is also demanding more biologists. The pharmaceutical houses which once relied on chemists and pharmacologists are now recognizing the need for zoologists, botanists, microbiologists, physiologists, bacteriologists,

[1]Presented to the New England chapter of the National Association of Biology Teachers at Bridgewater State Teachers College, Massachusetts, May 1954.

parasitologists and others widely trained in the biological sciences. With the advent of antibiotics and other drugs derived from living tissues, biological methods are invading the chemical industries. Cancer research institutions, hospitals, medical schools and universities with their continued expansion of research programs are looking for trained technicians and research assistants. Even the sales departments of chemical, pharmaceutical, and electronics industries are more interested in developing a personnel from science majors than business school graduates.

As Professor Weiss of the University of Chicago recently wrote: "This is the century of the biological sciences." The physical sciences have in recent years achieved a high degree of success and have offered in general more attractive opportunities to their members, but however impressive the results in the physical sciences, they will be in the long run but the tools which must serve those who seek to penetrate the nature of living things. The major task in the biological sciences still lies ahead to the new advances in agriculture, public health, and medicine which will depend so much for their development on basic biological research. Even outside the domain of experimental biology, investigations of far wider samples of existing fauna and flora are needed to unravel the mysteries of evolution. Biological expeditions in the future must go beyond the level of taxonomy and must be prepared to perform physiological, biochemical and other studies of organisms and their environment which will help to broaden the horizons of the growing science of ecology.

In recent years, biology on the advanced level has changed from a descriptive or historical to an analytical and dynamic approach to its subject. In research today, functions have been emphasized more than structures; physiology has replaced, to a large extent, morphology. Comparative Anatomy, the core of biology fifty years ago, is gradually being displaced by Comparative Physiology. Descriptive Embryology is being replaced in many university catalogues by Chemical or Experimental Embryology. The study of cells and tissues is now directed towards a cytochemical and histochemical approach. Although biology still needs the morphologist and anatomist, it needs even more the biochemist and biophysicist. Someone once said biology is an attitude and not an occupation. It takes all kinds of biologists to make the biological world, and all are essential to one another in developing a comprehensive study of living things. The field of biology is so vast, with so much yet to be discovered and explained, that it leaves to the curious and resourceful student an abundance of opportunities for initiative and originality. Since it is still a relatively young and undeveloped science, it can promise its students a wider variety of personal choice and a greater sense of service to man and his welfare than most other fields of science.

Biologists have been handicapped in the past by the fragmentation and over-specialization of their subject, and through a lack of a national organization comparable to the American Chemical Society for chemists and the American Institute of Physics for physicists. But this need has been filled recently by the establishment of the American Institute of Biological Sciences. It is hoped that this organization will make the public aware of the importance of the contribution of biologists to society, and increase the coherence and effectiveness of all branches and associations of biology.

We biologists, regrettably, have been slow compared to chemists, engineers, and physicists in bringing to the attention of young people the real nature of our science and the opportunities awaiting them. It may be that biology lacks the glamour and romantic appeal that engineering and medicine hold for young people. Economic security in biological fields, it is true, cannot compare at present with that of medicine and chemistry. But there are compensating factors for those who enjoy their work in biology that are not stressed sufficiently with students.

But more important is the lack of sufficiently attractive biology counselling material that could help high school and college counsellors in advising prospective and interested students. Up to now the only source material has been a few scattered bulletins by the government on various biological occupations and one detailed account entitled; "The Outlook for Women in the Biological Sciences." The Rice Research Associates, a private enterprise in Chicago, has published a booklet called "Bi-

ology Careers Manual." A committee under the auspices of the American Institute of Biological Sciences is currently working on a brochure in this area.

We can make a mistake, however, if we believe that the dearth of prospects for biology is due chiefly to prospective lower incomes or any one of these other factors. I wonder, if some of the blame cannot be placed on the methods of teaching the biological sciences that we have almost universally used on the high school and college level. Since only a small percentage of students taking biology courses will ever become professional biologists or even take advanced courses in biology, I wonder if too often our emphasis in elementary courses has been on the vocational rather than the avocational value of the course. Instead of making biology as attractive and challenging as it can and should be, too often it has appeared to students largely a matter of learning a difficult and sometimes baffling terminology. Even on the college level, there is often too much teaching of beginning courses as abridged graduate courses. Has it been that too often we have emphasized facts and information and neglected the beauty of our material? We know that facts are often trivial and more quickly forgotten by students. With our emphasis on didactic lectures we may have succumbed at times to the temptation of sounding dogmatic and violating, even in the laboratory, the spirit of inquiry that should be the main objective of every science course even in a general education program. How often do we not find a student in the laboratory hurriedly performing what he is told to do or following instructions of a manual as a young housewife does a cook book—all without reflection and discarding what he sees in favor of what some book has said? Why is it youngsters are fascinated by science hobbies, unite into innumerable junior science clubs, voraciously read science fiction, but find their science classes dull and unimaginative? Is it not because learning is too often made a chore instead of a challenge? If we are to stimulate and interest students in biology, then we must encourage them, on all levels, to find and solve problems, to collect specimens, and to perform experiments in the laboratory with a minimum of guidance. Above all, students must be introduced to the project method which will give them opportunities to express their own initiative, and bring out hidden talents and interests as perhaps nothing else will do. The science fairs that have become a part of many high school science programs definitely help fulfill these goals. Career conferences, visits to industrial plants, guided tours of hospitals and research centers are still other ways of interesting students in science and particularly the biological sciences. The summer program for outstanding biology high school students at Bar Harbor Laboratories in Maine, where young scientists work on projects in genetics and cancer has had a great deal of success in fostering interest in careers in biology. Financial aid in the way of scholarships is another thing that needs to be expanded.

All this will require more time and equipment for high school science teachers than are at present available to them. In a recent survey conducted by the National Science Teachers Association, the busy schedule of the average teacher was suggested as one of the chief factors preventing them from devoting more time to vocational guidance. There is a definite need for qualified, well trained, full-time science teachers on the high school level, if the science needs of society and the community are to be met. Yet in 29 states at present a teacher can be certified to teach science on the basis of study in just one science subject. In a nation-wide sampling of the background of biology teachers, less than one half were qualified or certified to teach a science course. The results of a survey conducted a few years ago on the origins of American scientists indicated that most of our outstanding scientists came from small liberal arts colleges where there existed a closer contact between the teacher and the students and where time was available for the guidance and direction.

If we hope to attract more students into careers in biology, we must, therefore, expand and publicize its attractions and reduce, as far as is honestly possible, its shortcomings. But the best way of attracting youngsters into our profession is through their courses in biology where the subject matter as presented by enthusiastic, well qualified teachers has the greatest appeal and is able to arouse their interest and desire to continue in such courses, and ultimately to adopt our profession.

High Schools and Biological Literacy in the United States

OSCAR RIDDLE
Founder of the National Association
of Biology Teachers,
Plant City, Florida

When numerous and well-informed friends of the public schools express an alarmed dissatisfaction with present public school performance all high school teachers have reason for thought and self-examination on that controversial subject. Perhaps few readers of these lines doubt that such criticism exists. Partly to point up its nature and prevalence, and partly to prepare a basis for these remarks on biological literacy, a recent incident will be cited and stressed: In one single issue (November 8, 1953) of the New York *Times Book Review* not one but three books condemning both the teacher-training and the educational philosophy of our schools were reviewed. The three books were surveyed by a single reviewer, Gordon K. Chalmers, President of Kenyon College. From his statement we quote:

> "The shortcomings of the public schools stem largely from inadequacies in the education of teachers; the center of the trouble in the teachers' colleges is their philosophy. On that two-fold premise these three books agree. Paul Woodring, a professor of psychology in a teachers' college, seeks remedies within the going principles and practices of the teacher education establishment. Arthur E. Bestor, a historian and University of Illinois professor, and Robert M. Hutchins, formerly chancellor of the University of Chicago, say that the troubles are so radical that correction will come only from outside the traditions and organizations which now control the schools."

Bestor and Woodring think John Dewey a genuine philosopher whose philosophy is misunderstood and misapplied by his disciples. Both credit progressive education with employing, at the outset, new methods for old purposes and with having livened up the study of arithmetic, grammar, language and history. But soon, the three authors agree, it abandoned the hard intellectual tasks of primary and secondary education—it "avoided the pain of thinking. It gave itself to the reform of society by means of generalizations and attitudes, to learning by doing and by studied amusement."

The largest of these three books is that of historian Bestor ("Educational Wastelands: The Retreat from Learning in Our Public Schools." University of Illinois Press, $3.50). It has been attacked with vigor in several educational journals, and perhaps some of its contentions deserve debate. But this book, like the same author's earlier critical article on "Life Adjustment Education" (Bulletin of Assoc. of Univ. Profs., Autumn, 1952), should be read by everyone teaching or supervising in a secondary school. Mr. Bestor examines the pretension involved in the words, Department (or School) of Education, insisting that in reality it is a department of education in pedagogical methods; that his own department (history) is actually a department of education in history; that all other university departments – mathematics, biology, language, chemistry, etc.—have a similar relation to education. "A Department of Pedagogy has no right to imply, by its name, that it has a greater concern with education than any other department."

Mr. Bestor praises pedagogy, noting the recent improvement, by means of applied psychology, in the art of teaching the very young. But knowing how to teach does not equip one to determine what to teach, and the professors of pedagogy have pretended that they know the aims, history and philosophy of education. "Professional educationists, in their policy-making role, have lowered the aims of the American public schools. It is not a lack of effort but lack of direction . . . . not a matter of money. It is a matter of adequate aims."

The nature of Mr. Bestor's analysis of those aims will be hinted at the end of this paragraph. Meanwhile, it is notable that he documents fully the cardinal charge that, during the past three or four decades, this educational

monopoly was obtained by the educationists through the certification laws of nearly all the states, which effectively exclude from public-school teaching the young people judged by the historians, the biologists, the chemists and other scholars to be most competent to teach these central subjects. We now quote:

"Most professional educators today are *not* talking about substituting one scholarly discipline for another. They stopped talking about that years ago. They are talking—as clearly as their antipathy for grammar and syntax permits them to talk—about the elimination of all the scholarly disciplines. They know perfectly well what they are doing when they look at the present-day world crisis and then solemnly recommend that the school contribute to national security, not by emphasizing history and economics and political science, but by asking their students to 'make studies of how the last war affected the dating pattern in our culture.' They know what they are doing, but do we?

. . . . professional educators have freed themselves from the restraining influence of scholarship and science, and have opened the schools to a most vicious and pervasive anti-intellectualism."

The present writer would not wish to approve other (unquoted) views in all of these three books. The additional discussions by Mr. Hutchins seem unsubstantial or misdirected. Also, one would wish to avoid over-criticism of the diversified performance of any group of professional educators. Biologists even slightly conscious of the bonds on themselves should readily grant that educationists, too, are not free. Nor is this article directly concerned with the extent to which those now teaching the sciences in high schools are inadequately trained for the tasks they are there actually performing, or with the startling shortage of persons now preparing themselves for that area of teaching. An effective discussion of those subjects can be found in the February (1954) issue of *Scientific American*.

Again, the present brief discussion of the kind of biological instruction required to make of us a biologically literate people does not imply that biology courses otherwise planned and oriented mean poor or unworthy instruction. The riches of our science is such, especially when its numerous technologies are lumped with it, that a dozen (or dozens) of wholly distinct one-year courses—each a worthy one—can easily be built from its subject matter. Indeed, precisely this fact of riotous over-abundance provides part of the reason that current courses and texts specifically aimed at biological literacy do not exist; the other part of the reason is that prevailing community sentiment largely precludes their existence—a point to be touched later. This short article discusses national biological literacy as a goal. It does not imply that the goal is attainable—only that it is desirable and surely unattainable while actual barriers are dimly seen and unopposed. It is written largely from concern about the role of the National Association of Biology Teachers in present efforts to bring a more favorable climate to the secondary school. Pressure for better teacher-training, and the struggle against prevailing anti-intellectualism, are basic tasks which it now shares with others.

In viewing present possibilities of making America biologically literate the conditions and trends already described have high importance. Too, there can be no doubt that the task itself is squarely on the shoulders of those who teach biology in our nation's secondary schools. If the high schools do not make us a biologically literate people we shall remain the biological illiterates that we have always been. That task is entirely beyond the possibilities, scope and aims of colleges and related higher institutions of learning. Their task is something of a quite different order. They can transmit scholarship from one generation to another; they can increase that scholarship through research; they can produce some books—other than scholarly ones—which fragments of the (unappetized) public may use to increase its literacy or its skill in many fields; their biological departments can touch lightly many who race through college, and they *must* train effectively those large groups of specialists—the technologists—who apply biology in the numerous indispensable fields of medicine, agriculture, forestry, health, conservation, and the rest; further, their biological departments *should* provide the essential training of a continuous procession of persons inclined to the teaching of biology—at both college and secondary levels. Who will declare

that this burden of college and university is not huge, heavy and restricted? Who will doubt that, in the past, frequent and blameworthy failure of the college to prepare enough and suitable teachers for secondary schools helped the educationists to take over and mangle that arduous job? More recently several colleges have implicitly acknowledged that failure. But the whole point here is that the hope for a biologically literate America rests directly on its secondary schools.

Something must now be said of the kind of literacy that is prointellectual; space and balance, however, set limits at scarcely more than a hint. From the Introduction to a recent book, Scientific American Reader (Simon and Schuster, New York), we quote:

> "Illiteracy in science presents its most alarming aspect as it prevails among otherwise educated members of our society. It promotes the antirational, illiberal mood presently ascendant in our culture. It has resulted in the almost complete estrangement of arts and letters from the sciences, which explains why our humanists largely miss the insights which science now offers into so many of their habitual concerns. Among engineers and scientists, all too often ignorant in fields outside their own, it has promoted a sterile insularity that shirks the cultural and social responsibilities of their profession.
>
> The authors, editors and readers of *Scientific American* also urge that to be conversant with science is as much a privilege as it is a responsibility of the times. The world as it is known to science is a far more various and splendid realm than any known to past generations of mankind . . . .
>
> There is little in the book about those sensations of the day which have identified science so firmly with technology in the public mind . . . . the interests of science are more closely allied with those of philosophy, history, ethics and esthetics than the engineering bias of much popular reporting would suggest. The structure of the universe and of matter, the origin of life and the reliability of our sensations and perceptions will be recognized as issues that have universal relevance to human life. They are concerned with the ends as well as with the means of our existence."

These words describe the nature and meaning of illiteracy in science in general as it now prevails "among the otherwise educated" persons. What this illiteracy involves for the uneducated public is barely touched.

The contribution of up-to-date biology to the intellectual life of man is immense in comparison with that of other sciences. Here one always remembers that biology is nevertheless heavily indebted to several sciences for success in extending itself. In any case biology is now a home for many sustaining luxuries of the mind. The grasp and vision of the continuous process of change throughout that long path from the non-living world to human society is a benediction to all thought. Here reason and research are rewarded in the most worthy of all ways—in a fear-free comprehension of ourselves and of our place in nature.

Donald Culross Peattie, an American botanist now turned writer, regards items in this area less as mental luxuries than as social or personal necessities. He wrote:

> "I say that it touches a man that his blood is sea water and his tears are salt, that the seed of his loins is scarcely different from the same cells in a seaweed, and that of stuff like his bones are coral made. I say that physical and biological law lies down with him, and wakes when a child stirs in the womb, ... and that these are facts of first importance to his mental conclusions, and that a man who goes in no consciousness of them is a drifter and a dreamer without a home or any contact with reality."

The species that stands upright and sometimes thinks seems somehow upborne by having learned that the worm can learn, that a bee can signal information to his fellows, and that the light produced by fireflies and phosphorescence is now understood by some of us. And if education is at all associated with comprehension, educators and others may one day find that the high school population could make some use of an *unleashed* biology.

Too, there is a firm and meaningful bond—a link of kinship and sequence—between the biological and the social. The social arises when men communicate and live together. It is the aggregate of individual human beings—communicating, purposing and planning, cooperating and competing with each other—that gives birth to that which we call society. Here we meet the truly great thing that our own species—the only surviving one endowed with speech—has created. And this superb achievement is dimmed only by the detail that most men have remained and now remain unconscious of their own role in this superla-

tive creative process. Society, as known to science, is itself a super-organism—the highest level reached in a long series of integrations beginning with the atom—and governed by rules or currents of human diversity and shift, production and skill, need and desire, of chance and law. Though those currents too must change with time, they are complex beyond compare; even the dead may advance or restrict society. The individual man—the social unit—that emerges from comprehensive biological study is thus already framed in dignity. When will secondary education find a place for him? Which generation that could now know man's stature will actually get access to that knowledge?

The two unfortunate outcomes of recent educational policy—taking the training of high school teachers from competent departments in the college, and ushering in an anti-intellectual climate for all high school teaching—would seem to offer sufficient discouragement to any and all subjects which demand extensive and firm knowledge from teachers and a measure of thought, concentration and work from pupils. But the particular subject, biology, has yet another, older and still more powerful antagonist in traditional community sentiment. Biology is pregnant with quite unconventional and widely unacceptable thought concerning human origin and destiny, concerning society, behavior and institutions. And the unsugared answers of biology in these centrally important matters can be neither taught nor closely approached in the primary or secondary schools of any nation in the world of 1954. The teachings of traditional religions everywhere forestalls such answers. From this source come the classroom silence on essentials, and the textbooks ravished to protect ancient faiths. If biological literacy comes to the people of the United States it will be supplied by the biology teachers of its secondary schools *despite* these triple handicaps. The task is not other, and no what less, than it is thus simply stated.

Problems and difficulties may not be resolved without fair estimates of their range and dimensions. Nor will those charged with striving to make America biologically literate be likely to succeed without appraisal and use of the appropriate resources at their command. Only the individual high school biology teacher, perhaps encouraged by the rare individuals and organizations that will lend him or her their support, has any immediately available resources. That individual teacher is at the very spot where failure or success is daily registered. In the meager time allotted this teacher to meet young America, how good are the chances to spread thought-provoking biological fact and outlook? Certainly the prospect is not good if teacher and textbook join in stressing trivial or detached fact rather than significant sequences and principles. And those chances and resources are likewise lost if or when accent is placed on biological technologies instead of on biological science. One may become reasonably literate in forestry and hygiene and remain essentially illiterate in biological science.

Who are the individuals to whom the detached biology teacher may turn, more or less immediately, for support of serious and sound efforts to increase the intellectual grasp and growth of pupils? Of course, that look is directed first to others of the teaching and supervisory staff of the high school. This search may often prove fruitless; but that biology teacher who is equipped by temperament and training to put his plight persuasively before associates in other disciplines, and before enlightened persons in the community, has a talent well suited to one need of the moment. It must often occur that others of the teaching staff share an urge to go beyond the superficial and the delectable in the education of our youth. Again, as indicated in our introductory paragraphs, many members of college faculties have now awakened to the prevalence and weight of two of the three millstones which submerge the teaching of biology in secondary schools. From this source one may begin to hope that some help is on the way.

Which institutions or organizations will now support the biology teacher's efforts to escape the three-fold teachers which now hold effective teaching of his science on leash? The loneliness of this landscape must much impress many a worthy soul. Only during the past fifteen years has one such organization of national scope appeared on the barren scene—The National Association of Biology Teachers. Even today that organization enrolls only a meager fraction of those for whom it exists; and the greater strength inherent in greater

numbers is still denied it by those who negligently or shamelessly—certainly unprofessionally—refuse to share in a common and always pressing cause. When—as chairman of a committee appointed by the Union of American Biological Societies—the present writer obtained in 1938-40 a grant of $10,000 from the Carnegie Corporation of New York, that sum was earmarked for the following purposes: (a) To establish an organization, national in scope, of teachers of secondary school biology; (b) to assist in founding an inexpensive journal to serve that society; (c) to obtain, through an extensive questionnaire, information on the status, special difficulties and problems of high school biology teaching from those who were then teaching the subject at that level; also to summarize, publish and distribute results obtained from that questionnaire (the latter required an additional grant in 1941 of $500; a few free copies of the Report are still obtainable from this writer). The writer also called previously selected delegates from several states to a meeting in New York on July 1-2, 1938. At that meeting the National Association of Biology Teachers and the AMERICAN BIOLOGY TEACHER were born. It is thus clear that at least a few persons and two organizations not directly involved in teaching secondary school biology recognized—several years ago—that teaching at that level greatly needed attention and support. Today's restraints on that teaching were known or suspected then. Those forces or practices which now restrain or prevent biological literacy in our country surely should be a primary concern of The National Association of Biology Teachers and its Journal. That is no trivial responsibility.

We quote here some lines published (Science Press, Lancaster, 1942) in the Report on the above-mentioned questionnaire. Teachers were asked to list the several topics they would "*emphasize* in a course in general biology." The summarizing statement (p. 64) reads:

> "Though the very large amount of highly informative material obtained on this item shows that many teachers of biology throughout the country have a sound grasp of their obligation and opportunity to teach a science, the data as a whole also show widespread tendencies to teach biology not as science, but (a) as a way to pleasing hobbies, or (b) as a series of practical technologies."

The people of the United States will be biologically literate: When a majority of them are familiar with the truly basic principle of integration and integrative levels—well understanding, that all chemical unions generate properties not present in the uniting particles; that this principle holds throughout the nonliving and the living worlds; that the early history of Earth was such that it *must* have formed numerous inorganic and organic compounds of the greatest significance to the origin and sustenance of life; that viruses show some but not all of the properties of life and organism; that organisms and society represent higher levels of integration—human society being the creation of speaking, gregarious man himself. When they know that, within organisms, the process of change from one species to another is now essentially known and defined. When they can view the parades of animal and plant worlds as mainly slow advances from the simple to the complex. When their thought about man includes those human species which preceded *Homo sapiens*. When they comprehend and accept the truth that several of their own genic propulsions to a particular talent or to lack of it—to susceptibility or immunity to several dreadful diseases—are things determined by the rules of chance. When they are no longer strangers to the method by which biology and other sciences have advanced. When they recognize that the biology and other science of a recent past looses new and freshened thought—about man and all nature—to this and all later generations of men. These are no technological toys; such is the core of our science.

These remarks have been directed to the nature and dimensions of the largest, most difficult, and least satisfactory area of biological teaching. It remains to note that means and prospects for eventual success, even for progress, in bringing biological literacy to the people of the United States are much affected by the kind of people we now are. It may be truly fortunate that this foremost unsolved task of biological education deals directly with plastic, as yet partly uncongealed, youth—with the ever-present bounce and curiosity of youth. For, quite generally, we Americans are uninformed; worse, we are complacently drifting

on or within the borders of anti-intellectualism. We are post-graduates only in gadgetry and in the hoopla and skills of production, sports and marketplace. Our recreations are modern and of marvelous variety, as often softening as geared to the gallop—a few of them gaily healthful, others even productively useful. Our daily existence, though the gamut of diversity as is that of other peoples, is now largely bedded down in comfort when not in luxury. Our portentous apathy to new or earned truth could flourish only in people born to a land overblessed by nature and in an isolated nation initially provided with much liberty by the battle and foresight of its Founding Fathers.

Biology in the News

BROTHER H. CHARLES, F.S.C.
Saint Mary's College
Winona, Minnesota

IT'S ALWAYS FISHING SEASON IN OHIO, Bill Wolf, *Sat. Ev. Post*, Sept. 4, 1954, pp. 25, 67-70.

You can take home all the Ohio fish you can catch—any kind, any size, any time. Ohio's Department of Natural Resources has made fishing more enjoyable and more productive without decreasing its fish population. This should stimulate discussion among your conservation-minded students.

A NEW HEART FOR PAMELA, William Peters, *Cosmopolitan*, Sept. 1954, pp. 8-13.

Pamela Schmidt had a gaping hole in her heart. How it was repaired and the experimental research which made it possible are told in an interesting manner.

HOW FRESH IS FRESH?, Frederick J. Stare, M.D., and Julia A. Shea, M.S., *McCall's*, Sept. 1954, p. 74.

Is there any difference in the food value of canned, frozen and fresh vegetables and fruits? This article may stimulate some lively discussion on the matter.

YOUR HEADACHE MAY BE JUST A PAIN IN THE NECK, Dorothy Williams and George R. Burns, *Collier's*, Sept. 3, 1954, pp. 22-24.

Stretching the neck relieves some kinds of headaches. This account should excite lively class discussion on the bad as well as the good effects resulting from reading such an article.

THE LAKE THAT TIME FORGOT, John Wesley Noble, *Collier's*, Sept. 3, 1954, pp. 40-43.

California's lonely Eagle Lake is the home of many strange animals the past history, structure and habits of which offer real challenges to zoologists.

HE SAVED A MILLION LIVES, John Kobler, *American Mag.*, Sept. 1954, pp. 45-46, 119-120.

What one man can do. In a 30-year battle against ignorance, fear and greed, Dr. Underwood, a former horse-and-buggy doctor, has made Mississippi one of the healthiest states in the nation.

UNDERWATER FUN, Howard Cohn, *Collier's*, Aug. 20, 1954, pp. 68-73.

Skin diving has opened another world to the biologist as well as to those in outdoor sports. Containing more pictures than text, this article may stimulate students to collect further information on this interesting hobby.

WE FOUND THE DEATH VALLEY BIGHORNS, John Wesley Noble, *Sat. Ev. Post*, Aug. 28, 1954, pp. 30, 88-90.

California's bighorn sheep still roam the mountains around Death Valley. This is a graphic acount of a trip to study and photograph them.

SO YOU THINK YOU ARE IMMUNE, J. C. Furnas, *Sat. Ev. Post*, Sept. 11, 1954, pp. 38-39, 92.

Immunization—whether from polio, typhoid, flu or whooping cough—is never absolute, says the author. This article merits careful reading; any other may lead to false conclusions.

KNOCKOUT, W. C. Heinz, *Collier's*, Sept. 17, 1954, pp. 94-97.

What is the secret of the knockout punch? This article devotes more attention to the hitting ability of great fighters than to the reasons why the temple, jaw, heart and solar plexis are the vulnerable spots.

DON'T SNEER AT THE CATFISH, Rufus Jarman, *Sat. Ev. Post*, Aug. 21, 1954, pp. 22-23, 77-78.

The several varieties of catfish living in the waters of the Missouri and lower Mississippi Rivers are despised by some and loved by others. Methods of catching them and preparing them for table are described.

A Combination Turtle-Frog Board

LLEWELLYN LICHT and
HAROLD M. KAPLAN
Southern Illinois University
Carbondale, Illinois

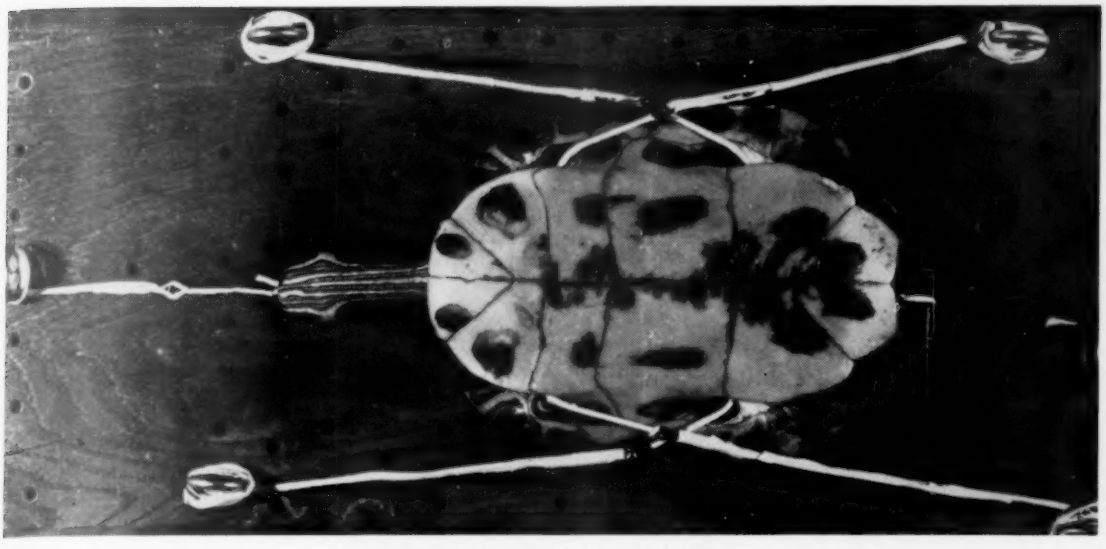

FIGURE 1—Turtle-Frog Board in Use.

Turtles are used extensively in biological teaching and research. They are especially suitable to demonstrate normal and pathologic aspects of cardiac activity, and the effect of cardiac drugs. They are an excellent source of blood, obtained readily by cardiac puncture.

Holding turtles in a fixed position has been difficult. A simplified board is described herein which allows effective immobilization whether the under-shell (plastron) is removed or left intact. The board (Fig. 1) is adaptable to any size of turtle within the ordinary range of investigative usefulness.

It is made from hard wood, preferably oak, practicable dimensions being 2″ x 10″ x 24″. Using a wood bit, one-fourth inch holes are drilled at many random locations, as illustrated. At the bottom of the board, these holes are widened and recessed with a one-half inch bit to a depth of one-fourth inch.

The turtle is placed carapace downward on the board. Four fish hooks (size 6/0), with their barbs previously cut off, are placed, two in front and two in back of the animal, as illustrated, so that the hooks grasp the bridge between the carapace and plastron.

The far end of each hook has previously been connected to a two-foot length of copper aerial wire (size 7/24, *i.e.*, seven strands, twenty-four twists per foot). Almost any wire is satisfactory if it is sufficiently malleable and durable. The connection between the wire and the hook, as well as the far end of the wire, may be taped to prevent injury to the experimenter's hands.

The far end of each wire is then wrapped around a vertical post. Each post is a straight eye bolt which can be placed at will in any one of the holes, its position being selected in accordance with the size of the turtle. The eye bolts are one-fourth inch in diameter, and their stems are three inches in length with twenty threads per inch. The stems are sawed off one and five-eighth inches below the base of the eye, and they are held fixed by rotary insertion into square nuts which are located within the recessed spaces at the bottom of the board.

The tail end of the carapace is stabilized with a fifth hook attached to a short piece of wire. The hook is placed posteriorly on the carapace, the wire is pulled vertically downward through a hole and then upward again through a more posterior hole, and finally, tightened around an eye bolt. This bolt is also placed to give the maximum leverage when the wire is drawn taut around it.

To operate on the turtle's neck, or to perform a cardiac puncture, the turtle's head and neck are pulled straight out of the shell with a tenaculum, a hook is inserted into the lower jaw, and a wire attached to this hook is fastened around an eye bolt placed directly in front of the head, but at a sufficient distance for effective leverage.

To obtain a cardiac puncture, one front limb is drawn aside, and a 20 gauge, one and one-half inch long needle is plunged, horizontally and parallel to the exposed neck, into the heart.

An immobilized animal is easily sexed, without the necessity of removing any part of the shell, by manually retracting one hind foot, making a unilateral incision into the abdominal cavity, and withdrawing by forceps enough of the pelvic viscera to visualize the gonads. With practice this is quickly done with a very little mutilation of structures.

The entire immobilization as described takes only a few minutes, and the animal is effectively quieted and secured.

The device may be used to tie down a frog, by inserting ordinary frog clips over the animal's limbs and into the one-fourth inch holes.

CASMT MEETINGS

The fifty-fourth annual convention of Central Association of Science and Mathematics Teachers will be held November 26 and 27, 1954, with headquarters at The Conrad Hilton Hotel in Chicago. An interesting program of papers in biology, chemistry, elementary science, elementary mathematics, general science, geography and physics has been arranged. Group programs involving problems in the areas of conservation, the elementary school, junior high school, and junior college will run concurrently on Saturday morning, November 27.

. Books for Biologists .

SCHOOL FACILITIES FOR SCIENCE INSTRUCTION. John S. Richardson, Editor, 266 pp., $5.50. The National Science Teachers Association, 1201 Sixteenth Street N.W., Washington 6, D. C. 1954.

A report of an extensive study of rooms and teaching facilities for science. It includes a list of supplies and equipment; sources of furniture, equipment and supplies; basic plans for science classrooms and laboratories; and suggestions for using community resources and audio-visual services. Interesting chapter titles include facilities for: Elementary School Sciences; The High School Multipurpose Science Room; High School General Science; High School Chemistry; High School Physics; Developmental, Applied, and Specialized Courses in High School Science; and College Facilities for the Education of Science Teachers.

WAYS OF MAMMALS. Clifford B. Moore. 273 pp., $3.50. The Ronald Press Company, New York. 1953.

A book for those who love animals and want to know more about them. It describes the behavior of mammals which are often misunderstood, and alleviates misconceptions, superstitions, and myths about them.

This volume provides teachers, members of museum and zoo staffs, editors, and general readers with authoritative answers to many common questions. The categories of mammals discussed include: hoofed; with pouches; those that fly; flesh-eaters; gnawers; aquatic; and monkeys, apes, and men.

PROTOZOOLOGY. R. P. Hall, 682 pp., $10.00. Prentice-Hall, Inc., New York. 1953.

A thorough coverage of the morphology, classification, physiology, and heredity, of the Protozoa. The last third of the book is devoted to the Protozoa which affect humans.

TAXONOMIC TERMINOLOGY OF THE HIGHER PLANTS. H. I. Featherly, 166 pp., 3.75. The Iowa State College Press, Ames, Iowa. 1954.

A convenient and concise source of information on taxonomic terminology with half of the book given over to a glossary of technical terms, and half devoted to classified terms (i.e., corolla, fruits, stamens, etc.), which enables one quickly to review the terms relating to the subjects classified.

(Continued on page 190)

PROPOSED AMENDMENTS TO THE CONSTITUTION AND BY-LAWS

The details of the proposed constitutional revisions are presented below. If these are approved at the Board of Directors meeting in Berkeley, California at the National Meeting they will be incorporated into the constitution. Additional suggestions or recommendations should be forwarded to Paul Webster, Secretary-Treasurer, Bryan City Schools, Bryan, Ohio.

PRESENT FORM

Article II.

Objectives

The purpose of this association shall be to organize the biology teachers on a national basis by local units of biology teacher associations in order to:

Article III.

Membership

SECTION 1. Membership in this association shall be open to all who are interested in the teaching of biological science.

Article IV.

Officers and Governing Boards

SECTION 1. Executive officers. The executive officers of this association shall consist of the immediate past president, president, president-elect, first vice-president, second vice-president, and secretary-treasurer.

SECTION 3. Executive Board. This board shall consist of the executive officers, the editor-in-chief of the journal and the managing editor.

Article VI.

Amendments

SECTION 1. An amendment of this constitution may be proposed by any affiliated chapter of biology teachers.

BY-LAWS

Article I.

Duties of Officers

SECTION 2. The president-elect shall assume all duties of the president in case of the absence of the president. The president-elect shall succeed to the office of the president the following year. The president-elect shall be responsible for the preparing of the program of the general meeting to be held at the annual meeting. He shall attempt to complete the program in sufficient time so that it may be published in an issue of the journal prior to the meeting. He shall work with the committee on local arrangements. He shall work under the direction of the president, making frequent reports of the progress of the program.

SECTION 3. The duties of the vice-presidents shall be to aid the president. They shall assist the president in the furtherance of the work and progress of the association.

Article II.

Nominations and Election of Officers

SECTION 1. A nominating committee of five classroom teachers, that are members in good standing in the association shall be appointed by the executive board. This committee shall make nominations for the offices of president-elect, first vice-president, second vice-president and secretary-treasurer, in conformance with Section Four of this article.

SECTION 4. At all times a majority of the executive board shall be classroom teachers of biology below the college level.

Article VI.

Officers and Boards of the Journal

SECTION 1. The official journal shall be controlled by an editorial board consisting of an editor-in-chief, a managing editor and a number of associate editors. The editor-in-chief shall be chairman of the editorial board. The members of the editorial board shall be appointed by the Board of Directors. At least one-half of the editorial board shall be classroom teachers of biology below the college level.

SECTION 2. An advisory board composed of not more than twelve (12) members shall be appointed by the Executive Board to assist and advise the editorial board.

Article VIII.

Affiliation with Similar Organizations

Affiliation with other national organizations with allied interests can be proposed only by a favorable vote of three-fourths of the entire executive board. If within a year's time after announcement of such a proposed affiliation, one-fourth of the total membership records in written form its disapproval of such a proposed affiliation that proposal shall thereby be cancelled. If such a dissenting vote is not recorded within one year's time the proposed affiliation shall automatically become binding upon the association.

PROPOSED AMENDMENTS

Article II.

Objectives

The purpose of this association shall be to organize the biology teachers on a national basis and to assist local units of biology teacher associations in order to:

Article III.

Membership

SECTION 1. Membership in this association shall be open to all who are interested in the teaching of biological science. There shall be two classes of membership, regular members and sustaining members.

Article IV.

Officers and Governing Boards

SECTION 1. Executive Officers. The executive officers of this association shall consist of the immediate past president, president, president-elect, first vice-president, second vice-president, third vice-president and secretary-treasurer.

SECTION 3. Executive Board. This board shall consist of the executive officers and the executive editors of the journal.

Article VI.

Amendments

SECTION 1. An ammendment to this constitution may be proposed by any affiliated group of biology teachers or by a committee appointed by the president and approved by the Board of Directors.

BY-LAWS

Article I.

Duties of Officers

SECTION 2. The president-elect shall assume all duties of the president in case of the absence of the president. The president-elect shall succeed to the office of the president the following year. The president-elect shall be responsible for the preparing of the program of the general meeting to be held at the annual meeting. He shall attempt to complete the program in sufficient time so that it may be published in an issue of the journal prior to the meeting. He shall work with the committee on local arrangements. He shall work under the direction of the president, making frequent reports of the progress of the program. He shall assume responsibility for continuance and maintenance of the file of "Who's Who in NABT."

SECTION 3. The duties of the first vice-president shall be to assist the president in promoting the interests of the association by securing and implementing the reports of the Chairman of National Committees.

SECTION 4. The duties of the second vice-president shall be to assist the president in promoting the interests of the association by the coordination of affiliate groups and the extension of these.

SECTION 5. The duties of the third vice-president shall be to assist the president in promoting the interests of the association by serving as National Membership Chairman with the responsibility of initiating and organizing promotion campaigns with the assistance of regional and state chairman and committees.

SECTION 6. (Same as the present section 4.)

SECTION 7. The duties of the past president shall be to serve as a consultant to the president in securing and budgeting the funds of the society, in interpreting and revising the Constitution and in promoting good public relations.

Article II.

Nominations and Election of Officers

SECTION 1. A nominating committee of five classroom teachers, that are members in good standing in the association shall be appointed by the executive board. This committee shall make nominations for the offices of president-elect, first vice-president, second vice-president, third vice-president and secretary-treasurer, in conformance with Section Four of this article.

SECTION 4. At all times the executive board shall be composed of a satisfactory balance between college and high school teachers of biology.

Article VI.

Officers and Boards of the Journal

SECTION 1. The official journal shall be directed by the members of the editorial board with executive responsibility. These shall include the editor-in-chief or co-editors, the managing editor and associate managing editor appointed by the Board of Directors.

SECTION 2. The editorial board shall be appointed by the Board of Directors and shall consist of the executive editors and assistant editors. Associate editors may be appointed. The editor-in-chief or one of the co-editors shall be chairman of the editorial board.

SECTION 3. (Same as present Section 2).

Article VIII.

Affiliation with Similar Organizations

SECTION 1. Affiliation with other national organizations with allied interests can be executed only by favorable vote of three-fourths of those present at the Board of Directors meeting. A proposed affiliation shall be published in the official journal or by written notice to all members at least sixty (60) days before being voted upon at a regular business meeting.

SECTION 2. Any member or group of members may submit his or their written opinion on such a proposed affiliation to the secretary-treasurer at least ten days before being voted upon by the Board of Directors. It then becomes the duty of the secretary-treasurer to make available to the members of the executive board for their consideration those opinions that have been submitted prior to being voted upon.

THE NOMINATING COMMITTEE REPORTS

For President-Elect

1. John P. Harrold

Biology instructor, Midland Senior High School, Midland, Michigan. B.S., Western Michigan College of Education; M.S., University of Michigan, Graduate work, Michigan State College, 15 years, teacher of biology in secondary schools. Member of NABT, NEA, MEA, AAAS, MSTA. Secretary-Treasurer NABT, 1948-1954. Chairman of Biology for Michigan Science Teachers Association, 1954-1955.

2. Dorothy Miller Matala

Iowa State Teachers College, Cedar Falls, Ia. A.B., M.A., Ph.D., in Nature Education at Cornell University; high school teacher of biology; 3 years junior college; Critic Teacher at University High School, Bloomington, Indiana; now teaching life science for elementary teachers; on Staff of Iowa Teachers Conservation Camp since beginning; Park Naturalist, Indiana State Parks, 3 years; member Phi Kappa Phi, Sigma Delta, Iowa Academy of Science, and America Nature Study Society; interests in outdoor education, nature recreation, school camping, birds, etc.; member State Committee on School Camping and Outdoor Education, NABT State Committee on Conservation; helps prepare and present weekly program on elementary science over WOI-TV.

For First Vice-President

1. Edna Higbee

University School, Pittsburgh, Pennsylvania. B.S., M.S., Ph.D., University of Pittsburgh. Has taught in high schools and St. John's Academy, graduate assistant in zoology and biology, lecturer in biology at the University of Pittsburgh. Research worker at St. Margaret's Hospital, Pittsburgh. Since 1944 has been Principal, head of biology department, and dean of women at University School. She has just completed her seventh year as president of the Biology Club of Southwestern Pennsylvania. Active in membership work for NABT. Member of many professional organizations, Dr. Higbee has been editor of The Biologist. Her professional field of interest has been in experimental morphology and has published several articles for professional journals. Dr. Higbee is listed in several standard reference works on educational and science leaders.

2. Emery Will

Head, Science Department State University Teachers College, Oneonta, New York. A.B., Hobart College; M.S., Ph.D., Cornell. Married and has two children. Teaching experience ranges from high school to Speed Scientific School of the University of Louisville, Iowa State Teachers College, and Conservation Camp of Iowa. Has had articles in Bios and the ABT. Is in charge of audio-visual news for ABT. Is a member of many professional organizations. Member of the Board of Directors of the American Nature Study Society. Iowa State Chairman of NABT Conservation Project. Has participated in many professional meetings and workshops on conservation education. Doctoral thesis concerned conservation education.

For Second Vice-President

1. Rex Conyers

University of Michigan faculty. B.S., M.Ed. (Conservation Education), University of Missouri; 16 years high school teaching; developed one of first large-scale high school conservation demonstration areas; pioneered project method of teaching conservation and biology; students consistently hold top-rank at 1800 Project Greater St. Louis Science Fair; member numerous educational and scientific organizations; President Missouri Science Teachers Association, 1949; charter member NABT, State Membership Chairman 1950-1953; member Conservation Project Committee; Consultant, summer camp work; Instructor of Adult Evening Class in Nature Recreation; author "Flight Schedule of Birds, Jackson County, Missouri"; co-author "Guide to Birding Areas of St. Louis Region"; Editor, St. Louis Audubon Society BULLETIN; local representative for NABT National Convention, 1952.

2. Enid A. Larson

Carmel High School, Carmel, California. A.B., M.A., University of California; major in Zoology, Pi Lambda Theta; Associate Sigma XI. 8 years experience as a microtechnician, including 4 years at Stanford University, School of Biological Sciences. 14 years teacher of biology. Taught summer sessions at San Francisco Junior College; Illustrated Lecture Series, Carmel Adult High School; Marine Biology, Pacific Grove High School; observer at Hastings Natural History Reservation. Edited, prepared and recored, the sound commentary for The Life Story of A Watermold for Phase Films. Prepared the Teachers Guide that accompanies this film. Received NSTA Teacher Award, 1953; have had 6 students receive awards from FSA. Recipient of a Fund for the Advancement of Education Fellowship, 1954-1955. California State Membership Chairman for NABT. Member of NABT since 1953. Life Member in NSTA.

3. Merl Russell

Royal Oak, Michigan. A.B., Michigan State College; M.S., University of Detroit; assistant editor of ABT. Member Cumulative Index Committee. President of Detroit Biology Club 1937-1939. Past President of the Science and Biology Sections of the Michigan Schoolmaster's Club. Past President of the Highland Park District of the Michigan Educational Association. Past President of the Highland Park Local of the American Federation of Teachers. Past Treasurer of the

Michigan Federation of Teachers. Second Vice-President of the NABT, 1940-1941; President-elect 1941-1942; President, NABT, 1942-1944; Secretary-Treasurer NABT, 1944-1947, Biology teacher in the Highland Park Junior College, Highland Park, Michigan.

For Secretary-Treasurer

1. Paul V. Webster

Biology instructor, Bryan High School, Bryan, Ohio; A.B. in Zoology, B.S. in Education, M.A., The Ohio State University. Member of numerous educational and scientific organizations. Ohio membership chairman for three years. Has attended all the national meetings since joining. Appointed by Board of Directors to fill out unexpired term of John Harrold, 1954.

BOOKS

(Continued from page 186)

BETWEEN THE TIDES. Philip Street, Philosophical Library, Inc. New York 16, N. Y. 175 pp. illus. 1953. $4.75.

This would be an interesting and informative book to carry along on a field trip or vacation excursion to the seashore. Simply written, in non-technical language, it is excellent for identification of many common beach and sea animals and for descriptions of their habits. Copiously illustrated, with both photos and diagrams, it would be valuable also as supplementary reading for life science classes, and for special reports or projects dealing with ocean life. Both the scientific and common names of the animals discussed are given in an appendix, and the index covers both text matter and illustrations.

THE STAFF

THE BOOK OF WILD PETS. Clifford B. Moore, 553 pp., $5.95. Charles T. Branford Company, Boston, Massachusetts. 1954.

Written for the school teacher and the layman, this book answers a multitude of questions concerning the care, feeding, and habits of fish, reptiles, insects, small animals and birds in captivity. Five chapters are devoted to the aquarium; four to the terrarium; two to insects and spiders as pets; four to mammals including the home zoo; and five to feeding and housing birds. The volume is well illustrated with 128 drawings and 214 photographs.

SCIENCE AND MAN'S BEHAVIOR. Trigant Burrow, xii+564 pp., $6.00. Philosophical Library, New York. 1953.

This is a rather expanded treatment of the idea that man's behavior can be described in a manner using physiological and psychological data.

PAUL KLINGE, *Co-Editor.*

ET. AL. PLANT GENERA, THEIR NATURE AND DEFINITION. C. H. M. Lawrence, Chronica Botanica Co., Waltham, Mass. Vol. 14, No. 3. pp. 89-160. 1953. $2.00.

This booklet is a report of a symposium organized by the American Society of Plant Taxonomists and the Botanical Society of America during the September 1952 meetings of the American Institute of Biological Sciences at Cornell University.

In addition to the symposium contributions the booklet contains a foreword by Dr. Verdoorn and an introductory essay on "*Generic Synopses and Modern Taxonomy*" by Dr. Theodor Just. Workers in the various branches of the plant sciences who are interested in the need for generic floras in phanerogamic botany will find this booklet interesting.

CHARLES C. HERBST
Beverly Hills High School California

NEW SENIOR SCIENCE. George L. Bush and Will S. Thompson, ix+642 pp., $4.28. American Book Co., New York. 1954.

This text is for a course in the 11th or 12th grades in what is essentially physical science. It fills expertly the need for such a text which synthesizes these sciences for non-science students who are mature and intelligent.

PAUL KLINGE, *Co-Editor.*

NABT NEWS

At the annual spring meeting of the AAAS Cooperative Committee on the Teaching of Science and Mathematics held in Chicago, Illinois the following officers were elected:

Chairman: Dr. John R. Mayor, University of Wisconsin, representative of the Mathematical Association of America.

Vice-Chairman: Laurence L. Quill, Michigan State College, representative of the Division of Chemical Education of the American Chemical Society.

Secretary: Bernard B. Watson, Operations Research Office of Johns Hopkins University, representative of the American Association of Physics Teachers.

NABT was represented by Muriel Beuschlein, who substituted for Prevo Whitaker, official representative to this AAAS Cooperative Committee.

Any member of NABT who is not receiving the AIBS Bulletin should notify Secretary-Treasurer Paul Webster, Bryan City Schools, Bryan, Ohio.